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Compte rendu de la réunion du sous-comité des poissons pélagiques du CEESP, 3 septembre 2003

September 3, 2003
Nanaimo, B.C.

J. King
Pelagic Subcommittee Chair

Fisheries and Oceans Canada
Pacific Scientific Advice Review Committee
Pacific Biological Station
Nanaimo, British Columbia V9T 6N7

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CSAS@DFO-MPO.GC.CA

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PACIFIC SCIENTIFIC ADVICE REVIEW COMMITTEE (PSARC)

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SUMMARY

The Pacific Scientific Advice Review Committee (PSARC) Pelagic Subcommittee met September 3, 2003 at the Pacific Biological Station, Nanaimo, British Columbia to review scientific information relating to British Columbia herring biology, distribution and assessment.

Working Paper P2003-02: Stock assessment for British Columbia herring in 2003 and forecasts of the potential catch in 2004

The five major herring stocks in B.C. are managed by a fixed harvest rate policy in conjunction with a fishing threshold or cutoff level. Cutoff levels are set at 25 percent of the estimated historic unfished average biomass. Cutoff levels have been established through stock-recruitment curves or bootstrapping of the observed recruitment time series. Biomass forecasts are provided for three classifications of recruitment assumption: poor, average and good. Poor, average, and good recruitment levels in the age-structured model are calculated as the mean of the lowest 33%, the mid 33%, and the highest 33% of the estimate of historic age-2+ fish abundance respectively. The Subcommittee reviews spawn survey information, perceptions of skippers and managers, age-structured model information, biological data and other auxiliary information, such as offshore mid-water trawl survey information for the West Coast Vancouver Island stock, to select the appropriate recruitment assumption. When information is incomplete or status of the stock is unknown, the default recruitment assumption is average unless there are three consecutive years of poor or good recruitment. In these instances, the recurring recruitment category is assumed. Yield recommendations are set at 20 percent of forecast annual biomass unless the forecast is close to or below cutoff levels. Assessments of major stocks in 2003 were conducted using an existing age-structured model, with alterations made to the estimates of an age specific availability parameter and the penalty weights for catch-at-age and spawn index data. The paper was accepted with revisions and the Subcommittee accepted yield recommendations outlined in Appendices 4-8.

For the five major stock assessment regions in B.C., the forecasted pre-fishery biomass for 2004 is 280,170 tonnes. This represents an approximate increase of 20% over the 2002 biomass level. This increase reflects improved recruitment for the Queen Charlotte Islands, Prince Rupert District, Central Coast and West Coast Vancouver Island stocks and continued good recruitment for the Strait of Georgia stock in 2003. However, it is important to note that the Queen Charlotte Islands stock is recovering from a severely depressed abundance level that was below the cutoff level in 2003. Application of the harvest policy results in a coastwide maximum potential yield of 55,510 tonnes for 2004.

Queen Charlotte Islands – The pre-fishery biomass forecast for 2004 is 12,740 tonnes (95% C.I.: 11,500 – 13,700 tonnes) assuming average recruitment. However, this stock is recovering from severely depressed abundance levels that were below

the cutoff of 10,700 tonnes in 2003. The forecasted biomass is close to the cut-off level and any harvest strategy should be precautionary. As such, the 20% harvest rate was not applied this year to the Queen Charlotte Island stocks. Instead, the potential harvest of 2,040 tonnes was calculated by subtracting the cutoff level from the forecasted biomass in order to maintain the stock at or above the cutoff level.

Prince Rupert District – The pre-fishery biomass forecast for 2004 is 40,710 tonnes (95% C.I.: 39,000 – 43,300 tonnes) assuming average recruitment. The forecast of returning biomass is above the cutoff level of 12,100 tonnes. Application of the 20 percent harvest rate to the forecast results in a potential harvest of 8,140 tonnes.

Central Coast - The pre-fishery biomass forecast for 2004 is 36,570 tonnes (95% C.I.: 35,200 – 38,400 tonnes) assuming average recruitment. The forecast of returning biomass is above the cutoff level of 17,600 tonnes. Application of the 20 percent harvest rate to the forecast results in a potential harvest of 7,310 tonnes.

Strait of Georgia - The pre-fishery biomass forecast for 2004 is 156,400 tonnes (95% C.I.: 145,500 – 176,200 tonnes) assuming good recruitment. The forecast of returning biomass is well above the cutoff level of 21,200 tonnes. Application of the 20 percent harvest rate to the forecast results in a potential harvest of 31,270 tonnes.

West Coast Vancouver Island - The pre-fishery biomass forecast for 2004 is 33,750 tonnes (95% C.I.: 31,600 – 35,700 tonnes) assuming poor recruitment. The forecast of returning biomass is above the cutoff level of 18,800 tonnes. Application of the 20 percent harvest rate to the forecast results in a potential harvest of 6,750 tonnes.

Minor stocks – Typically, potential harvest for minor stocks are identified as 10% of observed spawn biomass. The Subcommittee identified a potential harvest of 86 tonnes for Area 27. Applying the 10% harvest policy to Area 2 West would result in a potential harvest of 146 tonnes. However the Subcommittee cautions managers to consider this minor stock to be a recovering stock and to select a harvest level that is precautionary.

Working Paper P2003-03: Are offshore summer herring distributions useful predictors of recruitment strength for northern herring stocks?

This Working Paper is an exploratory investigation using the incidental catch of age-2 herring in groundfish research bottom trawls in Hecate Strait to forecast herring recruitment to northern stocks. The analyses suggest that the proportion of age-2 herring captured in summer trawls is correlated with the proportion of age-3 fish caught in the spring seine roe fishery. As such, it suggests that the proportion of age-2 herring observed in the summer in Hecate Strait can be used to forecast the recruiting age-3 fish in the following spring for the three northern herring stocks (Queen Charlotte Islands, Prince Rupert District and Central Coast). A summer mid-water trawl survey dedicated to collecting herring throughout Hecate Strait was initiated in the summer of 2003 and there are plans to continue the survey in the

upcoming years. Though the model results of this Working Paper are exploratory only and are not used to forecast recruiting age-3 herring for the 2004 fishing season. The models show promise and warrant further development of forecasting capabilities using trawl surveys.

SOMMAIRE

Le Sous-comité des poissons pélagiques du Comité d'examen des évaluations scientifiques du Pacifique (CEESP) s'est réuni le 3 septembre 2003 à la Station biologique du Pacifique, située à Nanaimo (C.-B.), pour examiner l'information scientifique sur la biologie, la distribution et l'évaluation du hareng de la Colombie-Britannique.

Document de travail P2003-02 : Évaluation des stocks de hareng de la Colombie-Britannique en 2003 et prévisions des prises potentielles en 2004

La pêche des cinq principaux stocks de hareng en C.-B. est régie selon un taux d'exploitation fixe, assorti d'une limite de pêche ou niveau seuil. Les niveaux seuil ont été établis à 25 % de la biomasse moyenne historique non exploitée estimée à partir de courbes stock-recrutement ou par la méthode bootstrap appliquée aux séries chronologiques du recrutement observé. Des prévisions de la biomasse sont fournies pour trois classes de recrutement hypothétique : faible, moyen et bon. Les niveaux de recrutement faible, moyen et bon dans le modèle de structure par âge correspondent respectivement à la moyenne du tiers le plus faible, du tiers moyen et du tiers le plus élevé de l'estimation de l'abondance historique des poissons d'âge 2+. Le Sous-comité examine les données tirées des relevés des géniteurs, les perceptions des capitaines et des gestionnaires, les données tirées du modèle de structure par âge, les données biologiques et d'autres données connexes, comme celles des relevés hauturiers au chalut pélagique du stock de la côte ouest de l'île de Vancouver, pour choisir la bonne hypothèse quant au recrutement. Lorsque l'information est incomplète ou que l'état des stocks est inconnu, on suppose par défaut que le recrutement est moyen, à moins qu'il ait été faible ou bon pendant trois années consécutives. En pareils cas, on suppose que le recrutement demeure constant. Le taux d'exploitation est fixé à 20 % de la biomasse annuelle prévue, à moins que la prévision soit proche du niveau seuil ou y soit inférieure. Les principaux stocks en 2003 ont été estimés par le modèle de structure par âge existant, et des corrections ont été apportées aux estimations d'un paramètre de disponibilité par âge et aux indices de pondération pour les données sur les prises selon l'âge et l'indice de frai. Le document a été accepté sous réserve de révisions, et le Sous-comité a accepté les taux d'exploitation recommandés figurant aux annexes 4-8.

Pour les cinq principales régions d'évaluation des stocks en C.-B., la biomasse prévue avant la pêche pour 2004 est de 280 170 tonnes, soit une hausse d'environ 20 % par rapport au niveau de biomasse de 2002. Cette augmentation reflète un recrutement amélioré dans les stocks des îles de la Reine-Charlotte, du district de Prince Rupert, de la côte centrale et de la côte ouest de l'île de Vancouver, et le

maintien d'un bon recrutement dans le stock du détroit de Georgia en 2003. Il convient cependant de noter que le stock des îles de la Reine-Charlotte est en voie de rétablissement depuis que sa biomasse a été inférieure au niveau seuil en 2003. L'application du taux d'exploitation donne une récolte potentielle maximale à la grandeur de la côte de 55 510 tonnes pour 2004.

Îles de la Reine-Charlotte – La prévision de la biomasse avant la pêche pour 2004 est de 12 740 tonnes (I.C. de 95 % : 11 500 – 13 700 tonnes), si l'on suppose un recrutement moyen. Ce stock est cependant en voie de rétablissement depuis que sa biomasse a été inférieure au niveau seuil de 10 700 tonnes en 2003. Comme la biomasse prévue est presque égale à cette limite, la stratégie d'exploitation devrait être prudente. Ainsi, le taux d'exploitation de 20 % n'a pas été appliqué aux stocks des îles de la Reine-Charlotte cette année. La récolte potentielle de 2 040 tonnes a plutôt été calculée en soustrayant le niveau seuil de la biomasse prévue afin de maintenir la biomasse du stock égale ou supérieure au niveau seuil.

District de Prince Rupert – La prévision de la biomasse avant la pêche pour 2004 est de 40 710 tonnes (I.C. de 95 % : 39 000 – 43 300 tonnes), si l'on suppose un recrutement moyen. La prévision de la biomasse retournant dans les eaux côtières est supérieure au niveau seuil de 12 100 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne des prises potentielles de 8 140 tonnes.

Côte centrale - La prévision de la biomasse avant la pêche pour 2004 est de 36 570 tonnes (I.C. de 95 % : 35 200 – 38 400 tonnes), si l'on suppose un recrutement moyen. La prévision de la biomasse retournant dans les eaux côtières est supérieure au niveau seuil de 17 600 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne une récolte potentielle de 7 310 tonnes.

Détroit de Georgia - La prévision de la biomasse avant la pêche pour 2004 est de 156 400 tonnes (I.C. de 95 % : 145 500 – 176 200 tonnes), si l'on suppose un bon recrutement. La prévision de la biomasse retournant dans les eaux côtières est de beaucoup supérieure au niveau seuil de 21 200 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne une récolte potentielle de 31 270 tonnes.

Côte ouest de l'île de Vancouver - La prévision de la biomasse avant la pêche pour 2004 est de 33 750 tonnes (I.C. de 95 % : 31 600 – 35 700 tonnes), si l'on suppose un faible recrutement. La prévision de la biomasse retournant dans les eaux côtières est supérieure au niveau seuil de 18 800 tonnes. L'application du taux d'exploitation de 20 % à la prévision donne une récolte potentielle de 6 750 tonnes.

Stocks mineurs – La récolte potentielle pour les stocks mineurs est habituellement établie à 10 % de la biomasse des géniteurs observée. Le Sous-comité a établi une récolte potentielle de 86 tonnes pour la zone 27. L'application du taux d'exploitation de 10 % pour la zone 2 Ouest donnerait une récolte potentielle de 146 tonnes. Cependant, le Sous-comité avise les gestionnaires du fait que ce stock mineur doit

être considéré en voie de rétablissement et qu'ils doivent choisir un taux d'exploitation prudent.

Document de travail P2003-03 : La répartition estivale du hareng en haute mer est-elle utile pour prévoir le recrutement dans les stocks de hareng du nord?

Ce document de travail constitue une étude exploratoire en vue de prévoir le recrutement dans les stocks de hareng du nord à l'aide des prises accidentelles de harengs de deux ans effectués au cours des relevés au chalut du poisson de fond dans le détroit d'Hécate. Les résultats suggèrent qu'il existe une corrélation entre la proportion de harengs de deux ans capturés l'été et la proportion de poissons de trois ans capturés dans la pêche printanière à la senne de harengs rogués. Ainsi, les résultats portent à croire que la proportion de harengs de deux ans observés l'été dans le détroit d'Hécate peut être utilisée pour prévoir le recrutement de poissons de trois ans au printemps suivant dans les trois stocks de hareng du nord (île de la Reine-Charlotte, district de Prince Rupert et côte centrale). À l'été 2003, un relevé au chalut pélagique a été effectué pour recueillir des harengs dans l'ensemble du détroit d'Hécate, et on prévoit poursuivre ce relevé au cours des prochains étés. Bien que les résultats du modèle ne sont que préliminaires et ne sont pas utilisés pour prévoir le recrutement du hareng de trois ans en 2004, le modèle est prometteur et justifie l'amélioration de la capacité de prévision à l'aide de relevés au chalut.

INTRODUCTION

The PSARC Pelagic Subcommittee met September 3, 2003 at the Pacific Biological Station in Nanaimo, British Columbia. External participants from industry and First Nations attended. The Subcommittee Chair, J. King, opened the meeting by welcoming the participants. During the introductory remarks the objectives of the meeting were reviewed, and the Subcommittee accepted the meeting agenda. The Chair presented recommendations and discussion items from the February 28, 2003 meeting of RMEC at which recommendations from the last Pelagic Subcommittee meeting were presented.

The Subcommittee reviewed two Working Papers. Working Paper summaries are in Appendix 1. The meeting agenda appears as Appendix 2. A list of meeting participants and reviewers is included as Appendix 3.

DETAILED COMMENTS FROM THE REVIEWS

P2003-02: Stock assessment for British Columbia herring in 2003 and forecasts of the potential catch in 2004

J. Schweigert (**Accepted subject to revisions**)

Subcommittee Discussion

The presentation of the 2003 PSARC herring assessment paper was brief and the presentation reviewed the highlights of the assessment with reference to some key tables and figures. A review of the forecast and observed trends for 2003 indicated that the observed spawning stock biomass (SSB) and recruitment estimates were very close to the forecasts made in 2002. The main exceptions were that the 2003 observed SSB in the Strait of Georgia (153,000 t) was considerably greater than forecasted (130,000 t), and that the recruitment to the west coast of Vancouver Island was good, not poor as forecast for 2003. The 2003 SSB, and the estimate of spawn deposition in the Strait of Georgia were the highest ever recorded.

The Author reviewed minor modifications to the age-structured analysis for 2003. Specifically, a logistic function was introduced to provide revised estimates of the 'availability parameter', that is equivalent to the maturity ogive. The 2003 model is now more consistent with other analysis that has found most age-3 fish to be sexually mature. Other modifications in 2003 concerned 'penalty weights' used to reflect the variation in the catch-at-age and spawn data and emphasis on each type of data in the model.

The first Reviewer began by commenting that it is discouraging to read that some key survey and analyses for herring stock assessment have been cut back due to lack of departmental resources, and that reliance on industry to fund key surveys is increasing. The Reviewer noted that since the model is not new and has been

extensively reviewed in previous years, that comments were of editorial, or clarification, nature. The Reviewer questioned the selectivity of the British Columbia seine fisheries. In the assessment, the seine fisheries are assumed to be non-selective and the Author confirmed that in the majority of instances this is the case. Some Subcommittee members disagreed, and offered that there could be some spatial variability because seine fisheries target on larger, earlier maturing fish. It was noted that this was 'fishery selectivity' and not 'gear selectivity'. For example, by pre-viewing catches in 'pursed' nets, skippers may decide to release catches of small fish – which is an instance of 'fishing selectivity' and not gear selectivity. The Author responded to the issue by commenting that the conclusion that there is evidence the seine gear is non-selective – and therefore this issue would not affect the generality of the results of the present analysis.

The second Reviewer suggested that the spawn index data could be weighted differently throughout its time series to reflect the switch to SCUBA surveys in 1987 and the concomitant increased reliability. The Author noted that this was investigated and made little difference to the results, but would be a good addition to the model in any event. A suggested direction for future work with the model is to investigate why the model systematically over-estimates or under-estimates age groups for certain regions. The Reviewer asked about natural mortality and why estimates vary between the five major stocks, specifically is natural mortality sensitive to changes in abundance? The Author replied that he agreed with the validity of the question and that the answer would require further research, although based on analyses and understanding to date, this does not appear to be a major factor affecting abundance estimates. Also, in separate modeling work, Dr. Caihong Fu is looking at this issue.

There was discussion regarding the two modifications made to the ASM this year: the changes to the availability parameter and the penalty weights assigned to the catch-at-age and the spawn index data. The Subcommittee noted that the model was the same, and only some parameter estimates had changed. The members wondered why this warranted a full review, and why the Subcommittee needed to review the assessment paper each year when few changes occur in methods. The PSARC Chair replied that the annual herring assessment is a high profile departmental activity with important implications, and as such, there would not be much support for streamlining this aspect of the assessment.

An External Participant from industry asked how the results of the Herring Science Review that was conducted independently from PSARC in 2003, would be incorporated into the herring assessment, and if it had been considered for this year's assessment process. The Author replied that there would be no direct input into this year's assessment, but there might be effects in future years, depending on the results of ongoing modelling by Dr. Caihong Fu.

An industry External Participant asked that Table 4.2 in the Working Paper be modified. They noted that, as presented, it appeared as if in most years the catch was 'over-quota' and that is not the case. The catch data in the table includes the

'test fishery catch' and as such will be more that the allotted quota. Subcommittee members agreed to the requested modification and also requested that in future years, the Table include actual harvest statistics of all herring fisheries, including Spawn on Kelp fisheries.

An External Participant asked why there are trends to retrospective abundance estimates for the Queen Charlotte Islands stock, specifically in the 1970s and 1980s. The Author replied that as the ASM adds more data, the retrospective analyses or estimates of spawning stock biomass changes, but why this is exaggerated in the 1970s and 1980s is unknown.

The Subcommittee discussion then considered the potential similarity and difference between the present age structured model and the model under development by Dr. Caihong Fu. For example, how would each model recognize the availability of age 3 fish? The Subcommittee wondered about future directions in herring assessment and associated biological research. The discussion focussed on the desirability of examining time-varying rates, or inter-annual changes in key parameters, such as mortality and availability and issues regarding stock structure and migrations. Some aspects of these questions may be addressed by the ongoing tagging study.

An industry External Participant noted that the modified parameter estimates resulted in a lower estimated biomass using the 2003 version of the model versus the 2002 version of the model. It was suggested that the decrease was approximately 29,000 tonnes coastwide. The most poignant and heated discussion of this Working Paper concerned the basis for the variation in retrospective estimates of abundance. The Author replied that while he acknowledged that there were differences in biomass estimates, he thought a decrease of 29,000 was incorrect and that it was not that large. It should be noted that review of the numbers following the meeting indicated that the changes to the model in 2003 resulted in a coastwide reduction in total biomass of about 3%.

A Subcommittee member suggested that any potential changes to parameter estimates should be made only after consultation with the Pelagics personnel and Subcommittee members. There was much discussion regarding this issue. Although the validity of the scales of the apparent reduction was not presented in tabular form to the Subcommittee, the discussion of the rationale for the changes appeared to divide the Subcommittee into two points-of-view. Some felt that the changes – and the procedures that the author used to implement them were valid and acceptable (i.e. the prerogative of the Author of the assessment document). Others felt that if important or substantive changes were made in the methodology, then it is essential to have rigorous scientific criteria as the basis for making changes. In this case, some argued that such changes could be presented and reviewed by a smaller group, prior to the annual PSARC meeting. In reply, others felt that the modifications made this year were not substantive changes to the methodology and that the Author had provided justification for the modifications. In addition, if modifications made each year needed to be presented and reviewed by a smaller group, it increases the

workload of the analysts who are in many cases already over-burdened. Some Subcommittee members felt that the time to review such changes was at the present meeting. The issue remained unresolved, but the Subcommittee agreed to accept the present assessment with the recommendation that in the next year, both the 2003 model and the previous 2002 iteration of the model should be presented.

Subcommittee members provided data and information for each assessment area on the completeness of catch reporting, spawn survey coverage, skippers' and managers' perception of stock status and incorporated it with information from the model. These criteria, along with yield recommendations, are presented here as Appendices 4-8. In the previous year, the forecasted pre-fishery biomass for the Queen Charlotte Island stock was below the cutoff level and no-harvest was recommended by the Subcommittee. It appears as if this stock is increasing in abundance, however the Subcommittee cautions that this stock is recovering and is close to the cutoff level. As such, the 20% harvest rate was not applied this year to the Queen Charlotte Island stocks. Instead, the potential harvest was calculated by subtracting the cutoff level from the forecasted biomass in order to maintain the stock at or above the cutoff level. The forecasted biomass is close to the cut-off level and any harvest strategy selected by managers should be precautionary.

The Subcommittee discussed the stock status of two minor stocks (Areas 27 and 2 West). There were no concerns regarding the 2003 spawn estimate (857 tonnes) for Area 27, and the Subcommittee agreed that 86 tonnes (based on the 10% harvest rule) was appropriate for this minor stock. The 2003 spawn data for Area 2 West was patchy, so the data are area specific. The estimate of spawning biomass for 2003 was 1,462 tonnes, however it was reported that the sounded biomass was higher than the spawn survey indicates. The Subcommittee acknowledged that in the previous year, they recommended no-harvest for this area due to very low (130 tonnes) spawning biomass. An External Participant suggested that these stocks should attain some cutoff level before harvesting is resumed. The Subcommittee agreed that the Area 2 West minor stock should be viewed as recovering, and that the managers should consider this when selecting a harvest level.

Subcommittee Conclusions

The paper was accepted with revisions and the Subcommittee accepted yield recommendations outlined in Appendices 4-8 of this report.

Subcommittee Recommendations

1. The Subcommittee recommended the maximum potential yields for each major stock assessment area as outlined in Appendices 4-8.

2. A maximum potential yield of 86 tonnes (based on the 10% harvest rule for the minor stock areas) is recommended for Area 27.

3. The Subcommittee recommended that managers consider the minor stock in Area 2 West to be a recovering stock and select a harvest level that is precautionary for this sensitive stock. A maximum potential yield of 146 tonnes (based on the 10% harvest rule for the minor stock areas) is recommended for Area 2 West.

4. A spawn survey should be conducted in 2004 in Area 2 West.

5. The Subcommittee recommended that the 2002 and the 2003 versions of the Age Structured Model be compared using data from 2003 to assess the differences in fit of the two versions. This comparison is to be presented at a future meeting for discussion by the Subcommittee.

P2003-03: Are offshore summer herring distributions useful predictors of recruitment strength for northern herring stocks?

T.W. Therriault (**Accepted with revisions**)

Subcommittee Discussion

This Working Paper investigated the utility of using the age compositions of herring collected during summer trawl surveys in Hecate Strait to forecast recruitment for northern (Central Coast, North Coast, and Queen Charlotte Islands) herring stocks. Initial data analysis of catches of herring collected incidentally during groundfish bottom-trawl research surveys in Hecate Strait suggested that proportion age 3 fish in the winter seine fishery could be forecasted from proportion age 2+ fish caught the previous summer in the bottom trawl survey. Consequently, a midwater trawl survey was conducted this summer throughout Hecate Strait to collect new data. The midwater trawl survey should be considered an exploratory survey to see if it has utility as a recruitment forecasting tool for northern herring stocks.

Fish collected during the groundfish research bottom trawl surveys were not aged. Fork length measurements to the nearest centimeter were taken onboard, and age was estimated based on this length. The Subcommittee noted that the error in estimating proportion at age is quite large with fork lengths, and collecting scales during this summer's mid-water survey is a good step. Sixty-nine percent of historic groundfish trawl samples were eliminated (i.e. not analysed). The Author used 3

rejection criteria to eliminate samples.[1] There was discussion about the impact of these rejection criteria, and whether the use of them was appropriate. The Subcommittee commented that the data from the mid-water trawl survey actually is the beginning of a new time series of data; that it could have different biases associated with it, and that it is probably not appropriate to mix the different data sets. It is unclear if the new data would be an extension of the historic time series or the beginning of a new one.

Subcommittee Conclusions

The Subcommittee commended the author on a valuable preliminary look at developing a forecasting tool for the northern BC herring stocks. The paper was accepted with revisions. These revisions include: 1) providing the data in tabular form and the equations used, 2) examining the influence of the strong 1988 year class on the regression results, 3) describing more clearly what parts of the historic dataset are excluded by each specific rejection criterion, 4) expressing the proportion age 2+ as a mean weighted by CPUE and 5) providing a figure to denote where bottom trawl samples were collected.

The Subcommittee concluded that this work should be viewed as exploratory only and that to use the model presented in the paper to forecast herring recruitment is premature. Subsequent research into developing a forecasting model should consider using similar methodology to the West Coast Vancouver Island recruitment forecasting approach, in particular weighting age group proportions to catch rates, and attempting to forecast proportion of age 3 in the pre-fishery biomass rather than biomass of recruits in the seine fishery. In addition, subsequent research should investigate using test fishery data in a regression model, and should incorporate retrospective analyses of the model's predictive capability.

Subcommittee Recommendations

1. Summer mid-water trawl surveys in the northern British Columbia regions should be continued. Future surveys should include Langara Island and Goose Island grounds.

2. Development of forecasting capabilities for northern British Columbia herring stocks should be continued and should be developed in conjunction with the existing approach used for the West Coast of Vancouver Island.

[1] Rejection criteria are as follows: 1) immature herring (age 1+ or age 2+ dominated the fishing event; 2) post-recruit herring (age 3+ or older dominated the fishing event; and 3) only single specimens of herring were landed in the fishing event.

APPENDIX 1: Working Paper Summary

P2003:02 Stock assessment for British Columbia herring in 2003 and forecasts of the potential catch in 2004

J. Schweigert

Herring stock abundance in British Columbia waters was assessed for 2003 and forecasts were made for 2004 using an age structured assessment model for the major stock assessment regions and an escapement model for the minor stocks in Areas 2W and 27. These models have been applied to assess herring abundance since 1984. As in the 2002 assessment changes to the analytical model were introduced to account for temporal change in the spawn index. A fixed spawn conversion or catchability factor was applied for the dive survey era beginning in 1988 and a free fitted parameter was estimated for the earlier surface survey period. In addition, a year specific logistic function was introduced to model the availability of fish on the spawning grounds. In addition, the effect of a range of penalty weights on a series of indicators was investigated and the penalty weight was increased on the spawn data and decreased on the catch-age data for the final assessment. The effects on overall biomass levels were minimal except for the Queen Charlotte Islands where it resulted in a slight decrease in abundance over the time series. All available biological data on total harvest, spawn deposition, and age and size composition of the spawning runs were used to determine current abundance levels. No significant problems were evident in the extent and comprehensiveness of the data collections. However, a number of samples from the Strait of Georgia were not aged due to resource limitations. All available data were included in and summarized from an Access database. Coastwide, the estimated pre-fishery stock biomass for all assessment regions in 2003 was 246,000 tonnes based on the age-structured model which represents a 28% increase over the 2002 abundance level. This increase reflects increased abundance in the south coast stocks particularly the Strait of Georgia. However, abundance in the three northern stocks also increased slightly as a result of a good recruiting 2000 year-class.

The estimated harvestable surplus in 2004 (20% of the 2003 forecast herring run) based on forecast abundance to the five assessment regions is 53,020 tonnes for the B.C. coast assuming average recruitment to all areas. However, since consensus on stock levels for each assessment region may change as a result of PSARC review of these data, forecast run sizes, and harvestable surpluses, are subject to change.

P2003-03: Are offshore summer herring distributions useful predictors of recruitment strength for northern herring stocks?

T.W. Therriault

Reduced biomass for some northern BC herring stocks has renewed interest in the accuracy of recruitment strength forecasting procedures. Such a forecast has been provided annually to PSARC for the WCVI stock since the late 1990s and such a forecasting tool could be developed for northern herring stocks. This paper uses existing herring data collected during groundfish research cruises in Hecate Strait to develop and evaluate possible recruitment strength models for each northern stock, QCI, PRD, and CC. The models are based on the relationship between pre-recruit fish in summer feeding aggregations (age-2+ herring) and recruit fish landed in commercial seine roe fisheries the following winter (age-3 herring). Although preliminary, the results to date are promising as a significant relationship was found for both the QCI and CC stocks. The PRD stock showed the same positive correlation but the relationship was not statistically significant. An example forecast was made for the 2003 fishery and was compared to the latest output from the 2004 herring forecast. The models predicted average recruitment for each of the QCI, PRD, and CC stocks. The 1999 year-class was stronger than expected and the observed proportion of age-3 herring in the northern seine fisheries was good. Thus, each of the three models under-predicted the recruitment strength, although the CC prediction was within 6% of the observed recruitment strength. Thus, although additional years of data are required to refine future forecasts, this tool has promise for northern BC herring stocks.

APPENDIX 2: PSARC Pelagic Subcommittee Meeting Agenda September 3, 2003

AGENDA
PSARC PELAGICS SUBCOMMITTEE MEETING

September 3, 2003
Seminar Room - Pacific Biological Station

Nanaimo, BC

Wednesday, September 3

8:30	Introductions and Opening Remarks.
9:00-11:00	Applicability of offshore surveys and recruitment forecast models Northern BC herring stocks (T. Therriault).
11:00 -12:00	Stock assessment for BC herring in 2003 and forecasts of the potential catch in 2004 (J. Schweigert).
12:00	*Lunch*
1:00-4:00	Schweigert continued.

APPENDIX 3: List of Attendees & Reviewers

Subcommittee Chair: Jackie King
PSARC Chair: Al Cass

DFO Participants	
* Subcommittee Members	
Anderson, Don*	
Chalmers, Dennis*	
Flostrand, Linnea	
Fort, Chuck*	
Hamer, Lorena*	
Hay, Doug*	
Henderson, Sharlene	
Hrabok, Christa	
Kristen, Daniel	
McCarter, Bruce*	
Midgley, Peter*	
Potyrala, Mark*	
Purdon, Rita	
Rusch, Bryan*	
Schweigert, Jake*	
Tanasichuk, Ron*	
Therriault, Tom*	
Thompson, Matthew	
Trager, Diana*	
External Participants:	**Affiliation**
Hall, Don	Nuu-Chah-Nulth Tribal Council
Hill, Cecil	Spawn on Kelp Operators Assoc.
Holkestad, Ross	Fishing Vessel Owners Assoc.
Johansen, Gina	Spawn on Kelp Operators Assoc.
Miles, Almudena	Kitkatla Nation
Moody, Reg	Heiltsuk Tribal Council
Safarik, Ed	Herring Conservation and Research Society
Ware, Dan	Consultant
Webb, Lloyd	Fishing Vessel Owners Assoc.

Reviewers for the PSARC papers presented at this meeting are listed below, in alphabetical order. Their assistance is invaluable in making the PSARC process work.

Tanasichuk, Ron	Fisheries and Oceans Canada, Pacific Region
Ware, Dan	Consultant
Wheeler, John	Fisheries and Oceans Canada, Maritimes Region
Zheng, Jie	Alaska Department of Fish and Game

Appendix 4. Criteria for assessment of stock status in 2003 and yield recommendation for 2004: Queen Charlotte Islands

Criteria	Status
1. Data Quality a) All catch reported b) All spawn surveyed c) Good sample coverage	 a) Yes. Managers estimated FSC. b) Yes c) Yes
2. Stock status and trends a) Age-structured model b) Spawn indices	 a) Increased slightly from 2002. b) Length doubled from 2002.
3. Perceptions of Stock Status a) Charter skippers comments b) Management staff	 a) Increase from the last two years and the soundings were very encouraging. b) Significant improvement from 2002 but still in a cautious regime.
4. Recruitment a) Age-structured model	 a) Poor recruitment 1999-2002; good recruitment in 2003
5. Retrospective Analysis a) Consistency	 a) Slight tendency to over forecast
6. Forecast Abundance a) Profile Likelihood b) Recruitment Assumption • Poor • **Average** • Good	 a) 95% C.I.: 9 000 - 12 000 tonnes b) Abundance / Harvest 10 540 t / 0 t **12 740 t / 2 040 t** 20 950 t / 4 200 t
7. Additional Information	This is a stock that is recovering and is close to the cutoff level. Any harvest strategy should be precautionary.
8. Cutoff:	10 700 tonnes
9. Yield Recommendation	Maximum potential yield of 2 040 tonnes

Appendix 5. Criteria for assessment of stock status in 2003 and yield recommendation for 2004: Prince Rupert District

Criteria	Status
1. Data Quality a) All catch reported b) All spawn surveyed c) Good sample coverage	 a) Yes. FSC incomplete for Big Bay. b) Yes. c) Yes
2. Stock status and trends a) Age-structured model b) Spawn indices	 a) Increased from 2002 b) Almost doubled from 2002
3. Perceptions of Stock Status a) Charter skippers comments b) Management staff	 a) Kitkatla stock spawn showed improvement. In Areas 3 and 4, stocks improved but were difficult to assess because of unusual distribution patterns. b) In Big Bay the test fishery samples were not representative of the total stock.
4. Recruitment a) Age-structured model	 a) Average 2000-2002, good in 2003
5. Retrospective Analysis a) Consistency	 a) Consistent
6. Forecast Abundance a) Profile Likelihood b) Recruitment Assumption • Poor • **Average** • Good	 a) 95% C.I.: 33 800 – 40 900 tonnes b) Abundance / Harvest 37 570 t / 7 510 t **40 710 t / 8 140 t** 50 810 t / 10 160 t
7. Additional Information	
8. Cutoff:	12 100 tonnes
9. Yield Recommendation	Maximum potential yield of 8 140 tonnes

Appendix 6. Criteria for assessment of stock status in 2003 and yield recommendation for 2004: Central Coast

Criteria	Status
1. Data Quality a) All catch reported b) All spawn surveyed c) Good sample coverage	 a) Yes b) Yes. Several milt only spawns. In Fitz Hugh Sound there were 5 km of milt, but no eggs. c) Yes
2. Stock status and trends a) Age-structured model b) Spawn indices	 a) Increased from 2002 b) Up slightly from 2002
3. Perceptions of Stock Status a) Charter skippers comments b) Management staff	 a) Slight improvement from 2002 b) Slight increase in soundings and spawn. More spawn in fringe areas. Less spawn in East Higgins.
4. Recruitment a) Age-structured model	 a) Poor in 2001; Average in 2002, good in 2003
5. Retrospective Analysis a) Consistency	 a) Consistent
6. Forecast Abundance a) Profile Likelihood b) Recruitment Assumption • Poor • **Average** • Good	 a) 95% C.I.: 29 800 – 35 700 tonnes b) Abundance / Harvest 33 700 t / 6 740 t **36 570 t / 7 310 t** 46 810 t / 9 360 t
7. Additional Information	
8. Cutoff:	17 600 tonnes
9. Yield Recommendation	Maximum potential yield of 7 310 tonnes

Appendix 7. Criteria for assessment of stock status in 2003 and yield recommendation for 2004: Strait of Georgia

Criteria	Status
1. Data Quality	
a) All catch reported	a) Yes
b) All spawn surveyed	b) No. There were 11 km above Little River and about 1 km northend of Denman Island that were not surveyed due to weather.
c) Good sample coverage	c) Yes, however about 31 samples did not get aged.
2. Stock status and trends	
a) Age-structured model	a) Increased from 2002
b) Spawn indices	b) Increasing since 2000
3. Perceptions of Stock Status	
a) Charter skippers comments	a) Stocks considered to be very strong and increasing
b) Management staff	b) Stocks continue to be very strong. Spawn returning to a more normal distribution pattern. Spawn duration was very short.
4. Recruitment	
a) Age-structured model	Good since 2000
5. Retrospective Analysis	
a) Consistency	a) Consistent
6. Forecast Abundance	
a) Profile Likelihood	a) 95% C.I.: 139 900 – 157 500 tonnes
b) Recruitment Assumption	b) Abundance / Harvest
• Poor	125 300 t / 25 050 t
• Average	137 600 t / 27 530t
• **Good**	**156 400 t / 31 270 t**
7. Additional Information	Juvenile survey in 2001 (recruiting in 2004) showed the second highest level of age-0+ juveniles. Offshore trawl survey forecasts average recruitment.
8. Cutoff:	21 200 tonnes
9. Yield Recommendation	Maximum potential yield of 31 270 tonnes

Appendix 8. Criteria for assessment of stock status in 2003 and yield recommendation for 2004: West Coast of Vancouver Island

Criteria	Status
1. Data Quality a) All catch reported b) All spawn surveyed c) Good sample coverage	 a) Yes b) Yes c) Yes
2. Stock status and trends a) Age-structured model b) Spawn indices	 a) Increasing slightly since 2000 b) Total spawn increased by about 25% from 2002
3. Perceptions of Stock Status a) Charter skippers comments b) Management staff	 a) Barkley Sound and Area 24 similar to 2002; stocks in Esperanza Inlet show significant improvement from 2002. b) Substantial increase in Esperanza; in Barkley Sound the sounding showed more fish, but spawning was less than spawn than the soundings indicated.
4. Recruitment a) Age-structured model b) Offshore trawl survey	 a) 1999-2000 was poor, 2001 was average; Implies good recruitment for 2002, but imprecisely determined b) Poor
5. Retrospective Analysis a) Consistency	 a) Tendency to over forecast
6. Forecast Abundance a) Profile Likelihood b) Recruitment Assumption • **Poor** • Average • Good	 a) 95% C.I.: 40 000 – 71 400 tonnes b) Abundance / Harvest **33 750 t / 6 750 t** 39 980 t / 8 000 t 56 110 t / 11 220 t
7. Additional Information	None
8. Cutoff:	18 800 tonnes
9. Yield Recommendation	Maximum potential yield of 6 750 tonnes